

CLAIMS

What is claimed is:

1. A target treatment apparatus for treating a target region (130) within a subject (140), the apparatus comprising:
 - 5 an MRI apparatus (100) for generating MR images during an MR scan of the subject disposed within an examination region (110);
an MRI localizer (150) for receiving the image data from the MRI apparatus wherein the target (130) is localized;
a reference marker localizer (160, 160') for non-invasively receiving reference data
10 from a plurality of reference points disposed in proximity to the target wherein the reference points are localized; and
a tracking processor (300) for receiving localized data from the MRI localizer wherein a relationship between the reference markers and the target region is generated.
- 15 2. A target treatment apparatus as set forth in claim 1 further comprising:
a treatment controller (460) for receiving: (i) the relationship between the reference markers and the target region from the tracking processor; and (ii) reference marker data from the reference marker localizer during a target treatment session, wherein an interventional tool (400, 400') is controlled to treat the target (130).
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3. A target treatment apparatus as set forth in claim 2 wherein the plurality of reference points are defined by a plurality of external markers disposed on the subject and the reference marker localizer comprises a plurality of video cameras (161₁, 161₂) for detecting the external markers.
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4. A target treatment apparatus as set forth in claim 2 wherein the plurality of reference points are defined by a plurality of points on the diaphragm of the subject and the reference marker localizer comprises a navigator processor (162') for identifying the reference points from a navigator scan.
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5. A target treatment apparatus as set forth in claim 4 wherein the interventional tool comprises a focused ultrasound ablator disposed within the examination region.

6. A method of treating a target region (130) within a subject (140), the method comprising:
generating magnetic resonance images of the subject disposed within an
5 examination region (110);
localizing the target region from the MR images;
non-invasively localizing a plurality of reference points disposed in proximity to the target; and
generating a relationship between the reference markers and the target region.
- 10 7. A method as set forth in claim 6 further comprising:
localizing at least a sub-set of the reference points during a treatment session; and
controlling an interventional tool based on the localized reference points from the treatment session which serve as input to the relationship between the reference markers
15 and the target region to estimate the location of the target.
8. A method as set forth in claim 6 wherein the plurality of reference points are defined by a plurality of external markers disposed on the subject and the reference markers are localized using a plurality of video cameras (161₁, 161₂).
- 20 9. A method as set forth in claim 6 wherein the plurality of reference points are defined by a plurality of points on the diaphragm of the subject and the reference points are localized using a navigator processor.
- 25 10. A method set forth in claim 7 wherein the interventional tool comprises a focused ultrasound ablator.
11. An apparatus for treating a target region (130) within a subject (140), the apparatus comprising:
30 means for generating magnetic resonance images of the subject disposed within an examination region (110);
localizing means for localizing the target region from the MR images;

reference means for non-invasively localizing a plurality of reference points disposed in proximity to the target; and

modeling means for generating a relationship between the reference markers and the target region.

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12. An apparatus as set forth in claim 11 further comprising:

means for localizing at least a sub-set of the reference points during a treatment session; and

10 interventional means for controlling an interventional tool based on the localized reference points from the treatment session which serve as input to the relationship between the reference markers and the target region to estimate the location of the target.

13. An apparatus as set forth in claim 11 wherein the plurality of reference points are defined by a plurality of external markers disposed on the subject and the reference

15 markers are localized using a plurality of video cameras (161₁, 161₂).

14. An apparatus as set forth in claim 11 wherein the plurality of reference points are defined by a plurality of points on the diaphragm of the subject and the reference points are localized using a navigator processor.

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15. An apparatus as set forth in claim 12 wherein the interventional tool comprises a focused ultrasound ablator.